「计蒜客」杯
第十一届山东大学ACM/ICPC校赛
新生组

Problem Set

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Contents

0 注意事项

- 若对题目描述有任何疑问，请通过PC^2发送Clarification。若设备出现任何问题， 请举手咨询现场工作人员。
- 任何妨碍评测进行或者破坏比赛公平性的行为均可能导致取消资格。
- 所有题目均从标准输入读入数据。请将结果输出至标准输出。
- 评测时各语言的编译器版本以及所用的编译命令为：
  - C (gcc 6.3.0): `gcc -lm -o <executable> <source_code> -std=c99 -O2`
  - C++ (g++ 6.3.0): `g++ -lm -o <executable> <source_code> -std=c++11 -O2`
  - Java (OpenJDK 1.8.0_121): `javac <source_code>`
  - Python2 (python 2.7.13): `python2 <source_code>`
  - Python3 (python 3.5.3): `python3 <source_code>`
- 对于C/C++选手，使用printf输出64位整形时应使用的格式为`"%lld"`或`"%llu"`。
- 某些题目数据量可能较大。对于这些题目，请使用效率较高的IO方法（如`scanf/printf`(C/C++)或者`BufferedReader/PrintWriter`(JAVA)）。

1 Problem A: Crossing cage

Time Limit: 1000ms

Description

There're many rats in the lab. But we only have a cage in the shape of a crossing. Forunately, the cage can be adjusted. That is, imagine that the lab is a rectangular field with $n \times m$ cells, once the cage has been put at (x, y), it will catch all rats in row x and rats in column y. However we have nowhere to release the rats so we have to catch them all within one usage of the cage. Now we want to know if we can eliminate all rats within one use of the cage.

Input Format

The first line consists of a single integer T denoting the number of test cases.

For each test case, the first line consists of two integers n and m meaning as above.

n lines follow, each one consists of a string of length m. "*" means a rat in that cell while "." means the cell is empty.

Output Format

For each test case, print "NO" (without quotes) in the first line if it is not possible to eliminate all rats within one use of the cage.

Otherwise print "YES" (without quotes) in the first line and two integers in the second line – the coordinates of the cell at which the cage should be deployed. If there are multiple answers, any of them will be accepted.

Sample Input

```
2
3 3
*..
.*.
..*
4 4
..*.
..*.
.***
..*.
```

Sample Output

```
NO
YES
3 3
```

Hint

$T \leq 10$

$1 \leq n, m \leq 1000$

Coordinates start from 1.

2 Problem B: Hamster orientation

Time Limit: 1000ms

Description

There're nine specially trainned hamsters in the lab. They form a square like this.

A	B	C
D	E	F
G	H	I

Initially they have random orientation, either facing north, south, east or west. You want them all to face north. However after consulting the trainer, you found that it's not possible to command an individual hamster to reorient. Instead, they always act in groups. There're nine commands listed below.

Command	Affected hamsters
1	ABDE
2	ABC
3	BCEF
4	ADG
5	BDEFH
6	CFI
7	DEGH
8	GHI
9	EFHI

When a command is issued, the corresponding affected hamsters will turn 90° clockwise ($N \to E \to S \to W \to N$...). Now you want to know the shortest list of commands you have to issue in order to make all hamsters face north.

Input Format

The first line consists of a single integer T denoting the number of test cases.

T test cases follow. Each one consists of the nine initial orientations of the hamster at the corresponding position. N=north, E=east, S=south, W=west. The initial orientations are given in a 3×3 square.

Output Format

For each test case, print a sorted sequence of commands issued in one line.

Sample Input

```
1
WWN
SSS
SES
```

Sample Output

```
4 5 8 9
```

Hint

The answer is guaranteed to be unique.

$T \leq 10$

3 Problem C: Triangle

Time Limit: 1000ms

Description

You have a triangle made of numbers. There're i numbers in the i-th row of the triangle. An example of such triangle may look like this:

```
1
3   2
4   6   5
9   8   10  7
15  12  14  13  11
```

You start from the top and you want to find a path to somewhere at the bottom. Each step can go straight down or diagonally down to the right. Find the maximum sum of numbers on the path.

Input Format

The first line consists of a single integer T denoting the number of test cases.
For each test case, the first line consists of an integer n denoting the number of rows in the triangle.
The following n lines describes the triangle.

Output Format

For each test case, print a single integer in one line denoting the maximum sum.

Sample Input

```
1
5
1
3 2
4 6 5
9 8 10 7
15 12 14 13 11
```

Sample Output

```
34
```

Hint

$1 < T, n \leq 100$
All integers in the triangle are between 0 and 99.

4 Problem D: Radioactive

Time Limit: 1000ms

Description

You are in charge of keeping a bunch of radioactive nuclear fuel safe. You have several containers, each having $N \times M$ cells in it. However not all of the cells can store nuclear fuel – a cell with nuclear fuel in it will explode if both the cell to the left and the cell to the right have nuclear fuel in it. Similarly an occupied cell can't have both the cells to the front and the cell to the back occupied or it will explode. Now you have X radioactive fuel pellets to store. You want to know the minimum number of containers required to store them safely.

Input Format

The first line consists of a single integer T denoting the number of test cases.
For each test case, there's only a single line consisting of the integers N, M and X.

Output Format

For each test case, print a single integer denoting the minimum number of containers required.

Sample Input

```
3
2 2 8
2 3 9
1 4 7
```

Sample Output

```
2
3
3
```

Hint

For the first sample, the container can be filled with pellets without exploding.
For the second sample, each container can have at most 4 pellets in it.
$T \leq 1000$
$1 \leq N, M \leq 10^4$
$1 \leq X \leq 10^9$

5 Problem E: Divisor game

Time Limit: 1000ms

Description

Alice and Marisa play a game together. This time they have the integers 1..M written on a piece of paper. They take alternate turn and as usual, Alice moves first. The one who makes the move choose an integer on the paper and erase its divisors including itself. The one who erases the last number loses. Given the number M, find who will win the game if they both play optimally.

Input Format

The first line of the input consists of a single integer T denoting the number of test cases.
For each test case, the only line consists of a single integer M meaning as above.

Output Format

For each test case, print a "Alice" if Alice wins or "Marisa" if Marisa wins (both without quotes).

Sample Input

```
2
1
5
```

Sample Output

```
Marisa
Alice
```

Hint

$1 \leq T \leq 1000$
$1 \leq M \leq 10^9$

6 Problem F: Ropes

Time Limit: 1000ms

Description

Suppose that we use $*$ to denote string concatenation, i.e. "asd" $*$ "jkl" = "$asdjkl$". Then string exponentiation is easily defined with the concatenation operator: $A^0 =$ "", $A^{(n+1)} = A * (A^n)$. For example "ab"^{3} = "$ababab$". Given a non-empty string S, find the largest integer n so that there exist a string A that $A^n = S$.

Input Format

The first line consists of a single integer T denoting the number of test cases.
For each test case, the only line consists of the string S.

Output Format

For each test case, print the answer n.

Sample Input

```
2
abcd
abababab
```

Sample Output

```
1
3
```

Hint

$T \leq 10$
The lenth of S doesn't exceed 10^6.
"Rope" is a jargon for a super long string.

7 Problem G: Reverse and Invert

Time Limit: 1000ms

Description

Given a string consisting of only "0"s and "1"s, its result after a "reverse and invert" operation is the string after reversing the original string (reading the string backwards) and exchanging the "0"s and "1"s in the string. For example, RoI("110000") = "111100" (RoI() is the reverse and invert operation). Now you have a string S, you want to find the number of non-empty substrings of S, each of which is the same to the original substring after going through a reverse and invert operation. A substring is a countiguous sub-sequence from the originall string.

Input Format

The first line consists of a single integer T denoting the number of test cases.
For each test case, the only line contains the string S.

Output Format

For each test case, print the answer in one line.

Sample Input

```
1
11001011
```

Sample Output

```
7
```

Hint

$T \leq 10$
Valid substrings for the sample are "10", "01" (both appear twice), "0101", "1100" and "001011".
Length of S doesn't exceed 500000.

8 Problem H: Tiling

Time Limit: 1000ms

Description

You are paving a straight path with slate tiles. You have an infinity number of red, green and blue tiles. The width of the tiles is equal to the width of the path and you want to arrange the tiles in a special way so that no two red tiles are adjacent. Tiles of the same color are indistinguishable. How many ways are there to pave a path of N tiles long?

Input Format

The first line of the input consists of a single integer T denoting the number of test cases.
For each test case, the only line consists of a single integer N meaning as above.

Output Format

For each test case, print a single line containing the answer modulo $10^9 + 7$.

Sample Input

```
2
1
2
```

Sample Output

```
3
8
```

Hint

$T \leq 10$
$1 \leq N \leq 10^6$

9 Problem I: eXclusive OR

Time Limit: 1000ms

Description

A sequence $x_1, x_2, ..., x_m$ is called a tri-xor sequence if for every $i(1 \leq i < m)$, $popcount(x_i \oplus x_{i+1})$ is a multiple of 3 (where $\oplus$ is the exclusive or operator, or the "^" operator in C/C++ or JAVA. *popcount* returns the number of 1's in the binary representation of the number). Suppose you have a sequence of integer $a_1..a_n$. You want to find the number of tri-xor sequences of length K where $\forall 1 \leq i \leq K, x_i \in a$.

Input Format

The first line of the input consists of a single integer T denoting the number of test cases.
For each test case, the first line consists of two integers n and K.
The next line consists of n integers denoting the elements from the sequence a.

Output Format

For each test case, print the answer modulo $10^9 + 7$.

Sample Input

```
2
5 2
1 2 4 8 15
2 1
1 1
```

Sample Output

```
13
2
```

Hint

Methods using the same number from different positions are treated as different $1 \leq T, n \leq 100, 1 \leq K \leq 10^{18}$

10 Problem J: Team up

Time Limit: 1000ms

Description

N people are going to team up for a contest. There're at most M people in a team. Find the minimum number of teams.

Input Format

The first line of the input consists of a single integer T denoting the number of test cases.
For each test case, the only line consists of two integers N and M meaning as above.

Output Format

For each test case, print the minimum number of teams in one line.

Sample Input

```
2
4 3
6 2
```

Sample Output

```
2
3
```

Hint

$T \leq 1000$
$1 \leq N, M \leq 10^9$